

Characterize Aerosols from MODIS/MISR/OMI/MERRA-2: Dynamic Image Browse Perspective

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NASA/Goddard Earth Sciences Data and Information Services Center (GES DISC)

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DQViz (Data Quality Visualization)

Introduction

Among the known atmospheric constituents, aerosols still represent the greatest uncertainty in climate research. To understand the uncertainty is to bring altogether of observational (in-situ and remote sensing) and modeling datasets and inter-compare them synergistically for a wide variety of applications that can bring far-reaching benefits to the science community and the broader society. These benefits can best be achieved if these earth science data (satellite and modeling) are well utilized and interpreted. Unfortunately, this is not always the case, despite the abundance and relative maturity of numerous satellite-borne sensors routinely measure aerosols. There is often disagreement between similar aerosol parameters retrieved from different sensors, leaving users confused as to which sensors to trust for answering important science questions about the distribution, properties, and impacts of aerosols.

NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) have developed a new visualization service (NASA Level 2 Data Quality Visualization, DQViz) supporting various visualization and data accessing capabilities from satellite Level 2 (MODIS/MISR/OMI) and long term assimilated aerosols from NASA Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) displaying at their own native physical-retrieved spatial resolution. Functionality will include selecting data sources (e.g., multiple parameters under the same measurement), defining area-of-interest and temporal extents, zooming, panning, overlaying, sliding, and data subsetting and reformatting.

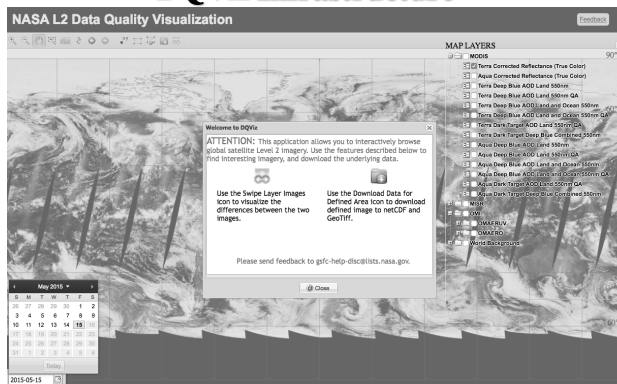
Data Available in DQViz

- MODIS**
Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the NASA's Terra and Aqua satellites have been key instruments to monitor atmospheric aerosols over the surfaces of dark and bright targets with a swath of 2330 km cross-track and 10 km along-track to cover the Earth daily. MODIS level 2 aerosol products have a spatial resolution of 10 km by 10 km at nadir for both Dark Target and Deep-Blue retrieval algorithms, and a spatial resolution of 3 km by 3 km at nadir from the Dark Target retrieval only.
- OMI**
Ozone Monitoring Instrument (OMI) flying on NASA's Aura satellite is a collaborative contribution of the Netherlands Agency for Aerospace Program and the Finnish Meteorological Institute to observe atmospheric components such as ozone, aerosol, NO₂, SO₂, HCHO, BrO, OClO, and cloud with a spectrum range of Ultraviolet and visible bands. The push broom telescope of the hyperspectral imaging spectrograph has a 114° field-of-view corresponding to 2600 km on the ground. OMI level 2 products have a spatial resolution of 13 km by 24 km at nadir with a daily global coverage.
- MISR**
Multi-angle Imaging SpectroRadiometer (MISR) of the NASA's Terra mission equips with nine push broom cameras with viewing angles of nadir, 26.1, 45.6, 60, and 70.5 degrees. It has four bands (blue, green, red and near-infrared). The cross-track swath with is ~380 km, thus MISR provides a global measurements every nine days.
- MERRA-2**
The second Retrospective analysis for Research and Applications (MERRA-2) is NASA's atmospheric reanalysis data assimilation system. MERRA-2 is enhanced with hourly diagnostic aerosol products of different types such as black carbon, organic carbon, dust, sea salt, SO₄, and SO₂. The grid size is 0.5°x0.625°.

Instrument/Model Specifications for DQViz Data System

Sensor/Model	Platform	Spatial Resolution	Equator crossing time ^a	Data period	Dataset DOI
MODIS	Terra	10x10 km	10:30 am	Jan'00-current	10.5067/MODIS/MOD04_L2.006
	Aqua	3x3 km	1:30 pm	Jul'02-current	10.5067/MODIS/MYD04_L2.006
MISR	Terra	17.6x17.6 km	10:30 am	Jan'00-current	10.5067/Terra/MISR/MIL2ASAE_L2.002
OMI	Aura	13.7x23.7 km	1:38 pm	Oct'04-current	OMI AERUV: 10.5067/Aura/OMI/DATA2004
					OMI AERO: 10.5067/Aura/OMI/DATA2001
MERRA-2		0.5°x0.625°		Jan'80-current	

DQViz Infrastructure



Help Science Team Users to Visualize Specific Scene

- Identify unique scenes
- Quality screening criteria according to algorithm recommendation
- Visualize different retrieval algorithms
- Cross platform/satellite inter-comparison

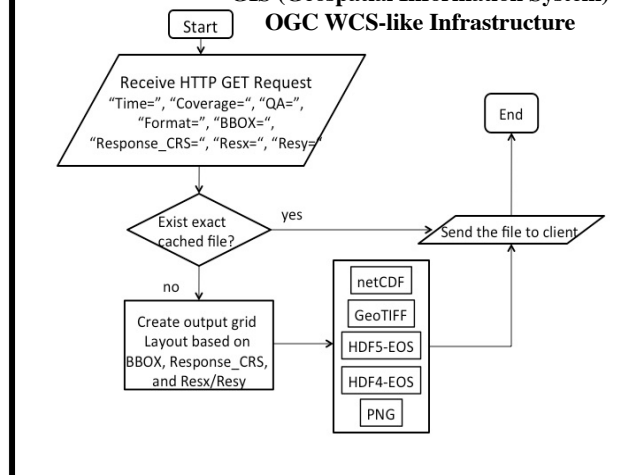
Help Research Community Users to Understand Satellite Data Quality via Visualization

- Importance of Quality Flags by Science Team Recommendation
- Importance of Data Lineage (Original and Processed Data Files)
- Episodic Event Viewer (Spatial Scale Independent)

Interoperable: Multiple output formats

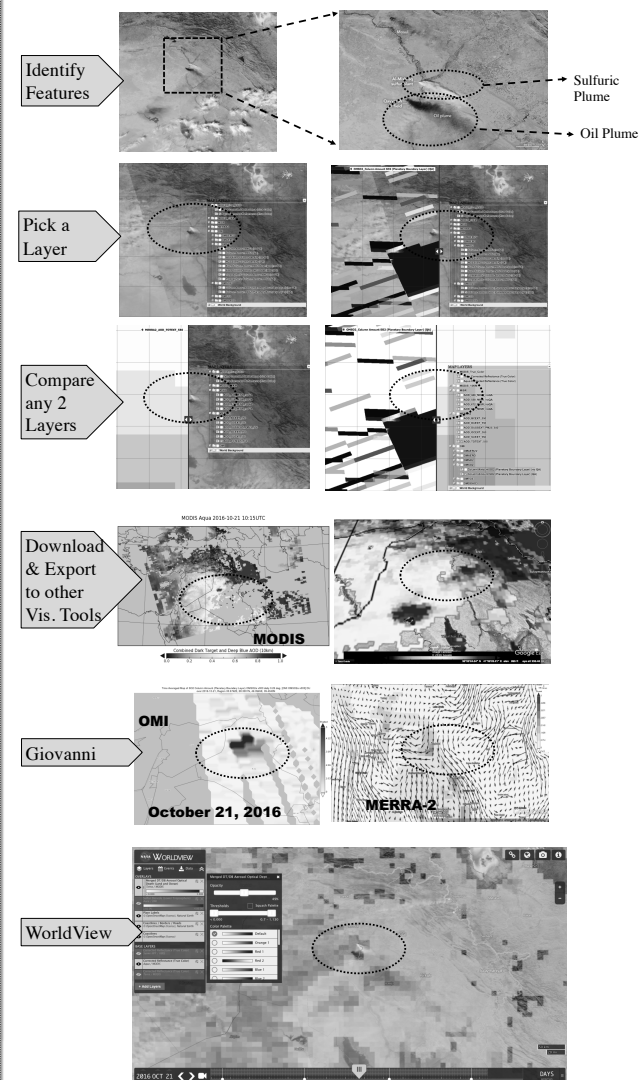
•netCDF
•GeoTiff

GIS (Geospatial Information System) OGC WCS-like Infrastructure



Use Case

A large sulfuric plume and an oil burning plumes are observed in northern Iraq between Mosul and Shirqat by MODIS Aqua on October 21, 2016. The development of spreading Black carbon and SO₂ plumes are observed by OMI and MODIS, and are shown in MERRA-2 simulations.



Acknowledgement:

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